

Title: Enough for Everybody: Division (Meaning, Estimating, and Remainders)

Brief Overview:

The students will use division strategies to determine approximate quotients of whole numbers with and without remainders. During the lesson, students will interpret quotients and remainders mathematically in context of problems.

NCTM Content Standard/National Science Education Standard:

Knowledge of number relationships and computation

Grade/Level:

Grades 3-5

Duration/Length:

Three 55-minute sessions

Student Outcomes:

Students will:

- Develop a meaning and understanding of division
- Determine approximate quotients of whole numbers
- Divide whole numbers without remainders
- Divide whole numbers with remainders

Materials and Resources:

Lesson 1

- Counters or other manipulatives used for counting
- Chart paper
- Resource Sheet 1- Student (1-inch Grid Paper)
- Resource Sheet 2 Student (Multiplication Chart up to 12)
- Overhead or a large poster of 1-inch Grid Paper used for modeling
- 1- inch Grid Paper
- Teacher Resource Sheet 3- Teacher (Student Work Sample)
- Teacher Resource Sheet 4 -Teacher (Example of Student Application)
- Student Resource Sheet 5- Student (Assessment Lesson 1)
- Student Resource Sheet 6- (Spinners)

Lesson 2

- Counters or other manipulatives used for counting
- Resource Sheet 2- Student (Multiplication Chart up to 12)

- Resource Sheet 1- Student (1-inch Grid Paper)
- Resource Sheet 7a 7b- Student (Compatible Numbers)
- Resource Sheet 8- Student (Assessment for Lesson 2)
- Resource Sheet 9a-9b- Student (2-Digit Number Sentence for Compatible Numbers)
- Resource Sheet 10a-10b- Student- (3-Digit Number Sentence for Compatible Numbers)
- Resource Sheet 11a-11b- Student- (Spinners)

Lesson 3

- Chart Paper
- Resource Sheet 12a-12b-Student- (Remainder Sheet)
- Resource Sheet 13- Student- (Assessment for Lesson 3)
- Resource Sheet 14- Student- (Summative Assessment)
- Resource Sheet 15- Teacher- (Summative Assessment Answer Key)

Development/Procedures:

Lesson 1

Preassessment -

Group students into pairs. Give each pair 24 counters. Tell students the story below. “Last night I went shopping and bought 24 cans of soup. I wanted to arrange the cans equally on the pantry shelf.” Using your counters show as many ways that you might arrange the cans. After you create an arrangement, record the display on your chart paper.

Launch –

Have each group share different ways to arrange the soup cans. After all the groups share, record the common results. Give each student a copy of Resource Sheet 2, Multiplication Chart to 12. Have students compare their arrangements with the multiplication chart (students should see the relationships with the facts: 1×24 , 2×12 , 3×8 , 4×6 , 6×4 , 8×3). If students do not automatically see the relationship to facts, guide them with prompting questions.

Teacher Facilitation –

Elicit the relationship between multiplication and division. For example, using the multiplication chart review that $3 \times 8 = 24$. Then count out 24 counters and create 3 groups. Then distribute the remaining counters into each group. Write on board $3 \times 8 = 24$ and $24 \div 3 = 8$. This should demonstrate that multiplication is related to division. Have students create a classroom definition of division. An example might be:

Division is the process of finding how many times one number is contained in another number.

Model the process of dividing with 15, then elicit how many equal groups can be created with this amount of counters (For example: count out 15 counters, create 5

groups, then distribute remaining counters to get $15 \div 5 = 3$ (See Teacher Resource Sheet 2- Multiplication Chart). Work with students to model $20 \div 4 = 5$. Model with manipulatives on grid paper. Have students work in groups to divide 21.

Student Application –

Pass out 2 sheets of grid paper (Student Resource Sheet 1), 36 counters and have the students divide the numbers 12, 18, 24, 30 and 36. Have students show the representation by coloring in the model and write the number sentences. (See Teacher Resource 3 and 4-Student Work Sample for model). For this activity you can divide the class into ability groups for differentiation by assigning the 5 numbers to different groups and have each group present their findings at the end (jigsaw, this is an example of the cooperative learning strategy). For example, if a group seems to understand the concept, then assign them 36. Have them arrange all the possible ways to show 36 by using the 1-inch grid paper and crayons. Some examples of number sentences would be: $1 \times 36 = 36$, $2 \times 18 = 36$, $3 \times 12 = 36$, $4 \times 9 = 36$, $6 \times 6 = 36$, $9 \times 4 = 36$, $12 \times 3 = 36$, $18 \times 2 = 36$, $36 \times 1 = 36$.

Embedded Assessment –

Distribute assessment Resource Sheet #5. For part **A** student should identify that 3 soccer balls will be put into 3 bags. For part **B** student should explain how they arrived at their answer. Answer should include dividing 9 soccer balls into 3 groups with 3 in each group. Students should explain how they distributed the soccer balls into 3 separate bags. An exemplary answer would include circling 3 soccer balls and drawing an arrow to a bag. Students should include an explanation on how and why they selected the amount they chose for each bag.

Reteaching/Extension –

Introduce the following game, Division Spin. Students are to get a spinner, 1-inch grid paper, and counters (or other manipulatives, the multiplication chart can be used if teacher desires). Two different spinners have been provided on Student Resource Sheet 6, depending on the level of the students.

Students are to work alone or in groups. The student is to spin the spinner and whichever number the spinner stops on the student is to divide the number into equal parts. They can use the manipulatives to divide the number and then draw the groups on the 1-inch grid paper for teacher to check for accuracy. If a student lands on a number more than once they must come up with another way to divide the number.

Lesson 2

Preassessment

Put students in groups of 2. Present students with the problem, *“Amanda was having a birthday party. She had 47 candy bars. She wanted her and each of her friends to have an equal amount. If she invited 8 friends how many candy bars will each of them receive?”* Pass out 47 counters or other manipulatives that can

be used to model division. Allow students to use the manipulatives to explore the number of candy bars each person will receive. Have the students make an estimate of how many candy bars each friend will get. Students should make an estimate and keep it in their head.

Launch

After each group had a chance to explore, record each students' estimate on the board. Have each group share how they arrived at their answers. Have the class decide on how to estimate quotients. Guide the students to the concept of compatible numbers. (Compatible numbers are changing numbers to other numbers that form a basic fact to *estimate* and answer. For example: $133 \div 4$ becomes $120 \div 4 = 30$).

Teacher Facilitation

Lead students to the concept that compatible numbers will help them divide numbers that are not perfect divisors. Compatible numbers are easier to use than rounding because it will always give you an equal answer. Go over the activity students already completed. Explain to students that 47 was the total and there were 9 people. What number is close to 47 that has a common factor of 9. Model with the multiplication chart. Highlight the row and column for 9. Ask the students what number is close to 47. Elicit answers from the students. They should say 45. Then explain that since we want an estimated answer we would change 47 to 45 and divide 45 by 9 to get 5. Therefore, each person will get 5 cookies.

Present the problem to the students. (Allow students to use the multiplication chart if they need assistance.)

Michael has 33 baseball cards. He wants to put 4 cards on a page in his album. About how many pages will he need to use in the album? Have the students work in groups of two to identify the compatible number. Distribute Student Resource Sheets 7a & 7b-Compatible Numbers to each student. Have students complete the activities and then discuss the results.

Teacher can model with larger numbers. Share "Sue wants to decorate her 4 bedroom walls with pictures of her favorite singer. She found 183 pictures. About how many pictures will she have on each wall?"

Write the number 173 on the board. Put a box around 18 and cross out the 3. Using the Think Aloud Strategy say, "What multiple of 4 is close to 17?" Use the multiplication chart to show that 16 is the closest number to 17. Using the Think Aloud Strategy say, "How many groups of 4 is close to 17?" The answer is 4. Bring the students attention to the crossed out 3 and remind them since we are estimating, the ones column number is always a zero. Therefore, the answer is 40.

Student Application

Continue on Resource Sheet 6-Student Spinners. Have students use the remaining story problems to solve. Be sure the students are using compatible numbers and are recording their choices. Students are to be able to explain why they chose the compatible number.

Embedded Assessment

Use Resource Sheet 8- Student for the assessment. Be sure students have manipulatives and a multiplication chart.

Reteaching/Extension

Give students Resource sheet 9 or 10- Number Sentences2-digit. Give students two spinners (Resource Sheet 11a & 11b, one for the divisor and one for the dividend) Students are to spin the assigned spinners. First the students will spin the dividend spinner and record the number, then they will spin the divisor spinner and record the divisor. By spinning these numbers the student will create a division problem. Have the students solve the problem using compatible numbers. For example, if the divisor was 175 and the divisor was 6 they would write:

1	7	5	÷	6	=	
---	---	---	---	---	---	--

Compatible Number						Estimated Answer	
1	8	0	÷	6	=	3	0

Have the students complete this activity 5 times.

Lesson 3

Preassessment-

Divide the students into groups of 4. Give each group of students 59 counters or other manipulative that can be used as counters. Tell them the story below.

Over the summer my rich Aunt Flora went on a cruise around the world. She visited 59 cities and she has a picture of herself in front of each Welcome To Sign. In her Places I Visited Scrapbook, she wanted to put 5 pictures on each page. About how many pages will she need to complete her scrapbook?

Have students think about yesterday's lesson and be sure they find a compatible number to get an estimated answer. Have the students verify their answer prior

to them reporting. Have the students solve by themselves, allow them to record their thought on chart paper.

Launch

After giving students time to explore and solve the problem, allow each group to share their estimate. Record the student group estimates on the board. Be sure to compare the estimates to the final responses.

Students are to share their ideas with one another. After students share teacher will compare their estimates to the actual answer. Be sure to stress the importance of estimation when dividing. Have students model how they made their estimate. Be sure to identify the actual answer and the extra numbers called the remainders.

Teacher Facilitation

Present students with the following problem. *“My daughter had a swim meet at the local university’s pool. In order to get everyone there we had to car pool. There were 13 children on the team. If 3 children were able to fit into each car, how many cars did we use?”*

Talk the students through this problem. Be sure to find an estimate (compatible number is 12, estimate is 4) Use grid paper and counters to represent how to divide the 13 into equal groups of 3. After all counters are distributed into the 3 groups find the number of cars that were used. There are 4 cars needed, however there is one left over. Therefore, a fifth car was needed to transport the remaining child. Discuss that you cannot have a remainder of a car, so you must add another car. When modeling introduce the terms dividend, divisor, quotient and remainder. Also discuss that the remainder cannot be larger than the divisor.

However the remainder is 1. 1 was not used and therefore it is the remainder. Remainders are the left over amount that does not fit into a group equally.

Model with the students. Present the problem below. *Last night Mrs. Carmen bought a bucket of chicken for dinner for her, her husband and her three children. There were 17 pieces of chicken. Each person wanted to have an equal amount of pieces of chicken. How many pieces of chicken will each person get to eat?*

Find the compatible numbers first. $17 \div 5 =$ Count out 17 counters and make 5 groups. The compatible number for $17 \div 5$ is 15. Therefore each person is estimated to get 3 pieces of chicken. Distribute the counters into equal groups to find the remainder.

Student Application

Have students complete the activity using Resource Sheet 12a and 12b-Remainder Sheet. Directions are on Resource Sheet 12a. Have the students complete Resource Sheet 12a. While students are completing this activity go from group to group to observe student thinking and task completion. During

this time, you can differentiate instruction by reducing or increasing the number of counters. Share with students that the total number of counters is called the dividend, the number of cups is the divisor, the amount in each cup is the quotient and the amount left over is the remainder.

Embedded Assessment

Have students use Resource Sheet 13-Day 3 Assessment.

Reteaching/Extension

Have students play the game, “Doughnuts in a Box.” Draw a box on the chalkboard. Write the numbers 2-9 in the divisor box .and 2- digit numbers in the dividend box. Divide the class into 2 teams, one team will be dividend team, the other the divisor team. The first student from each team comes to the chalkboard and circles a number. After the students have each circled a number, tell them to divide the 2 circled numbers. The first student to write the correct answer gets a point for his team (The answers are written outside the box). Mark through the 2 circled numbers. Continue until all numbers have been used. The team with the most points wins.

Dividend	Divisor
29 31 38	9 7
55 43	2
83	6
67 33	3
17 77	4 5 8

Summative Assessment:

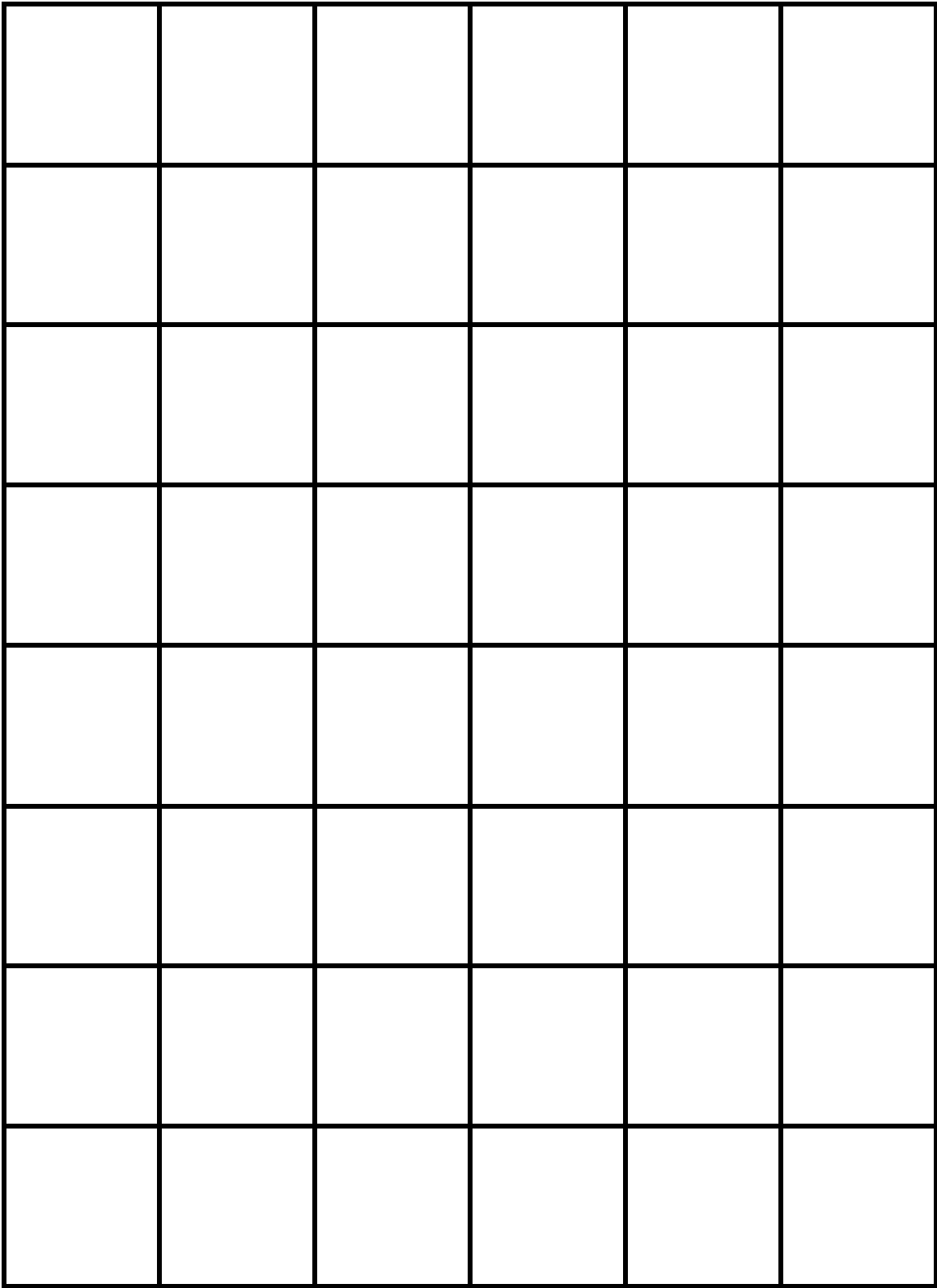
See Resource Sheet 14. Students can use any manipulative that was used during class instruction.

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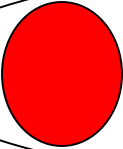
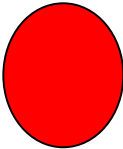
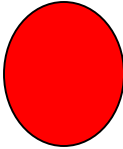
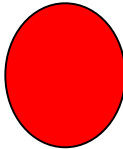
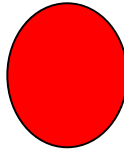
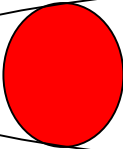
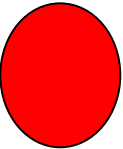
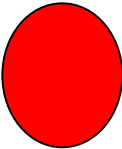
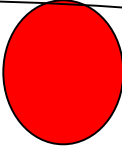
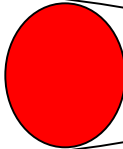
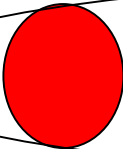
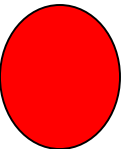
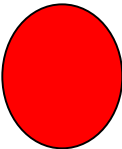
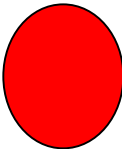
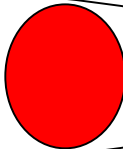
1-Inch Grid paper



Multiplication Facts Chart

×	0	1	2	3	4	5	6	7	8	9	10	11	12
0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	1	2	3	4	5	6	7	8	9	10	11	12
2	0	2	4	6	8	10	12	14	16	18	20	22	24
3	0	3	6	9	12	15	18	21	24	27	30	33	36
4	0	4	8	12	16	20	24	28	32	36	40	44	48
5	0	5	10	15	20	25	30	35	40	45	50	55	60
6	0	6	12	18	24	30	36	42	48	54	60	66	72
7	0	7	14	21	28	35	42	49	56	63	70	77	84
8	0	8	16	24	32	40	48	56	64	72	80	88	96
9	0	9	18	27	36	45	54	63	72	81	90	99	108

Student Work Sample

					
					
					
Number Sentence	$15 \div 3 = 5$				

Example of Student Application

This is a sample of what the students work may look like. Students are to do as many as they can for each 12,18,24,30 and 36. Teacher may want to assign different groups to do different values for differentiation.

A 6x6 grid illustrating division. The grid is divided into three horizontal sections. The top section consists of 3 rows, each containing 4 green squares, with a bracket on the right labeled $12 \div 3 = 4$. The middle section consists of 1 row containing 6 white squares. The bottom section consists of 2 rows, each containing 6 blue squares, with a bracket on the right labeled $12 \div 2 = 6$.

Assessment Lesson 1

A. Look at the pictures of the soccer balls below. Luther has to put an equal amount of soccer balls into each of the 3 bags. How many soccer balls will he put into each bag?

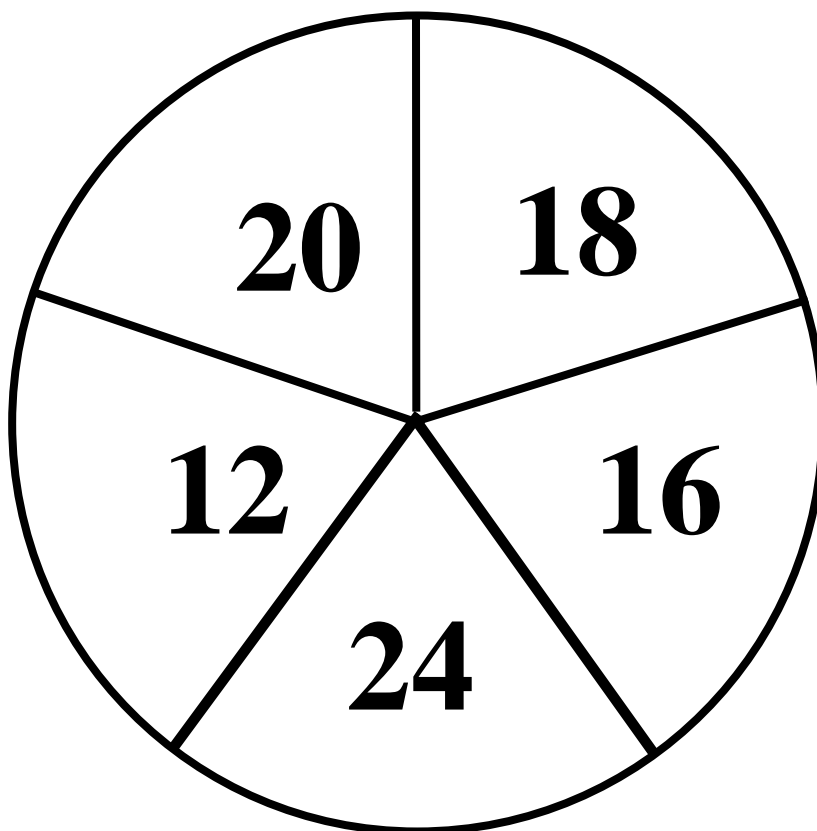


B. Using what you know about division to explain how you know why your answer is correct. Use pictures, words, numbers and/or symbols in your explanation.

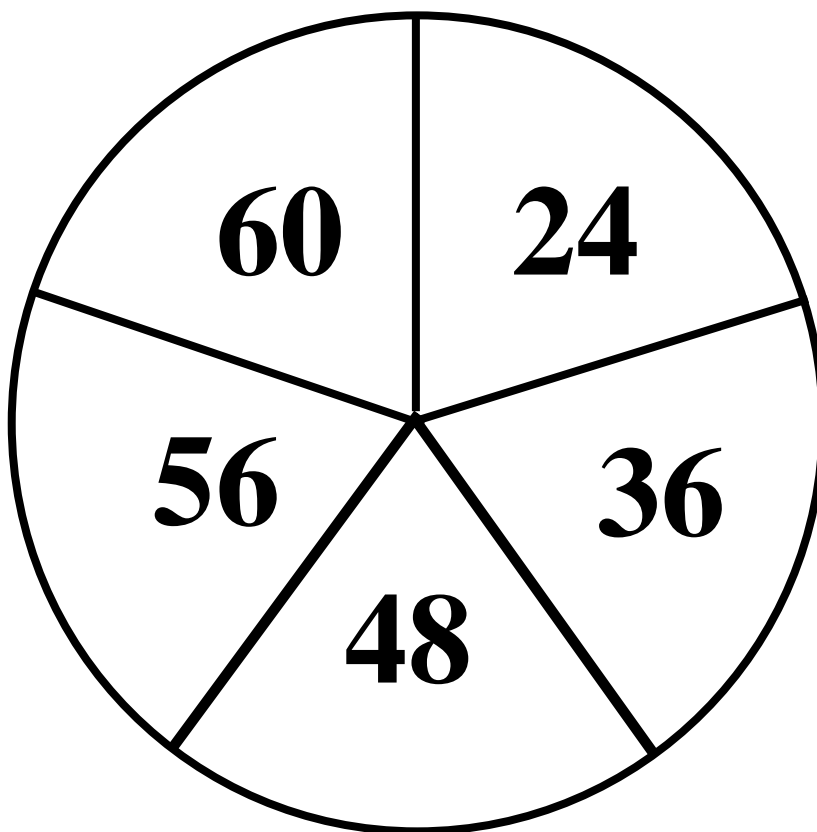


Spinners

*Easy
Spinner*



*Harder
Spinner*



Compatible Numbers

Michael has 33 baseball cards. He wants to put 4 cards on a page in his album. About how many pages will he need to use in the album? Have the students work in groups of two to identify the compatible number.

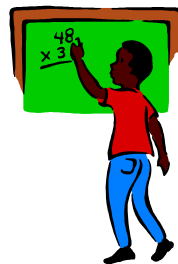
Compatible Number is _____

Michael will need _____ pages for his baseball cards.

Alvin has 23 compact disks. He wants to put 4 CD's on a page in his CD wallet. About how many pages will he need to use in the wallet? Have the students work in groups of two to identify the compatible number.

Compatible Number is _____

Alvin will need _____ pages in his CD wallet.



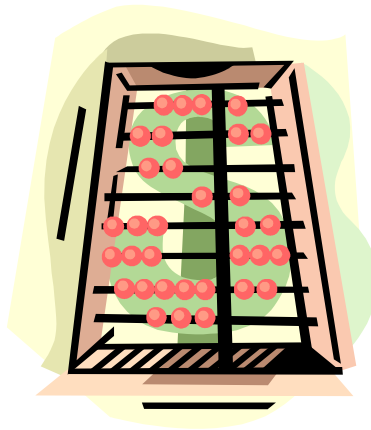
Compatible Numbers

Your cousins went bicycling on a trip of 183 miles to Williamsburg, Virginia. It took them 9 days. About how many miles did they travel each day?

Compatible Number is: About _____miles each day.

Basketball coaches try out 488 students during 8 sessions. About how many students try out at each session.

Compatible Number is: About _____ students in each session.



Assessment: Lesson 2

Directions: Use your manipulatives and multiplication chart to solve. Be sure to find the compatible number to find the quotient.

A. Henry has 47 toy cars. His parking garage has 6 levels. About how many cars can park on each level?

Compatible Number is _____

Henry can park about _____ cars on each level.

B. Victoria saved \$241 in 7 months. About how much money did she save each month?

Compatible Number is _____

Victoria saved about \$_____ in 7 months.

C. Chose one problem from above and explain how you found its compatible number.

Number Sentences 2-Digit

$$\square \square \div \square = \square$$

Compatible

Estimated
Answer

$$\square 0 \div \square = \square$$

$$\square \square \div \square = \square$$

Compatible

Estimated
Answer

$$\square 0 \div \square = \square$$

Number Sentences 2-Digit

$$\square \square \div \square = \square$$

Compatible

Estimated
Answer

$$\square 0 \div \square = \square$$

$$\square \square \div \square = \square$$

Compatible

Estimated
Answer

$$\square 0 \div \square = \square$$

Number Sentences 3-Digit

$$\square \square \square \div \square = \square$$

Compatible

Estimated
Answer

$$\square \square 0 \div \square = \square$$

$$\square \square \square \div \square = \square$$

Compatible

Estimated
Answer

$$\square \square 0 \div \square = \square$$

Number Sentences 3-Digit

$$\square \square \square \div \square = \square$$

Compatible

Estimated
Answer

$$\square \square 0 \div \square = \square$$

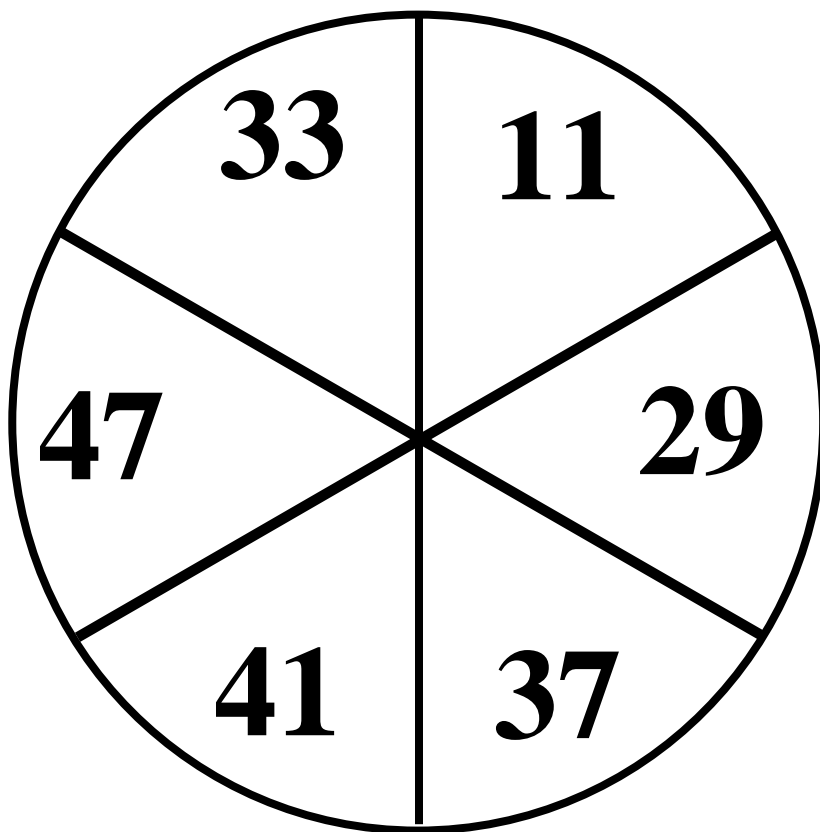
$$\square \square \square \div \square = \square$$

Compatible

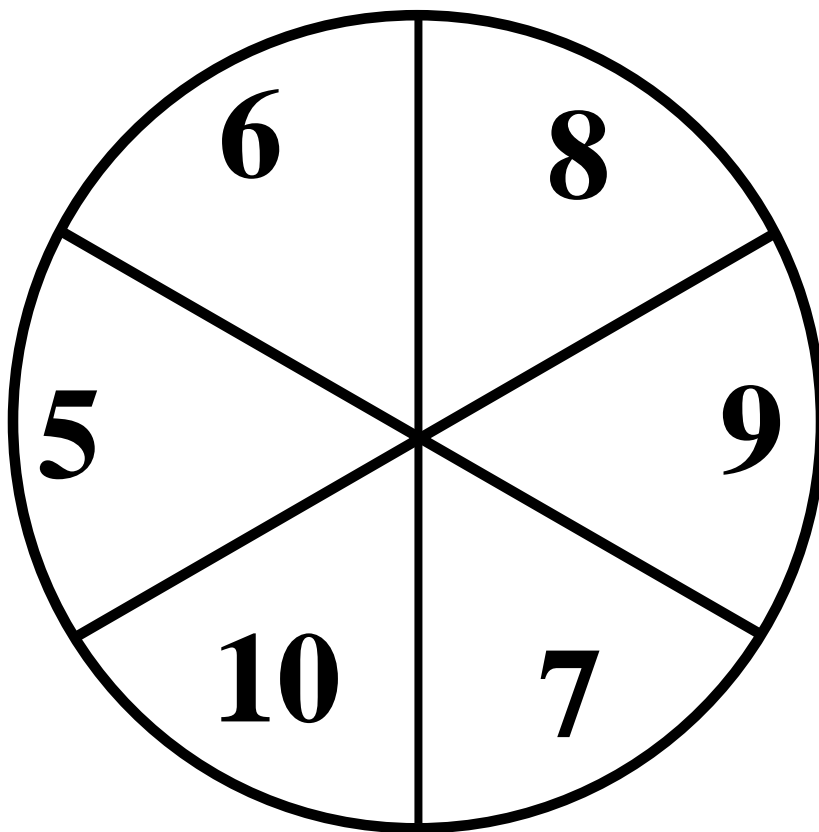
Estimated
Answer

$$\square \square 0 \div \square = \square$$

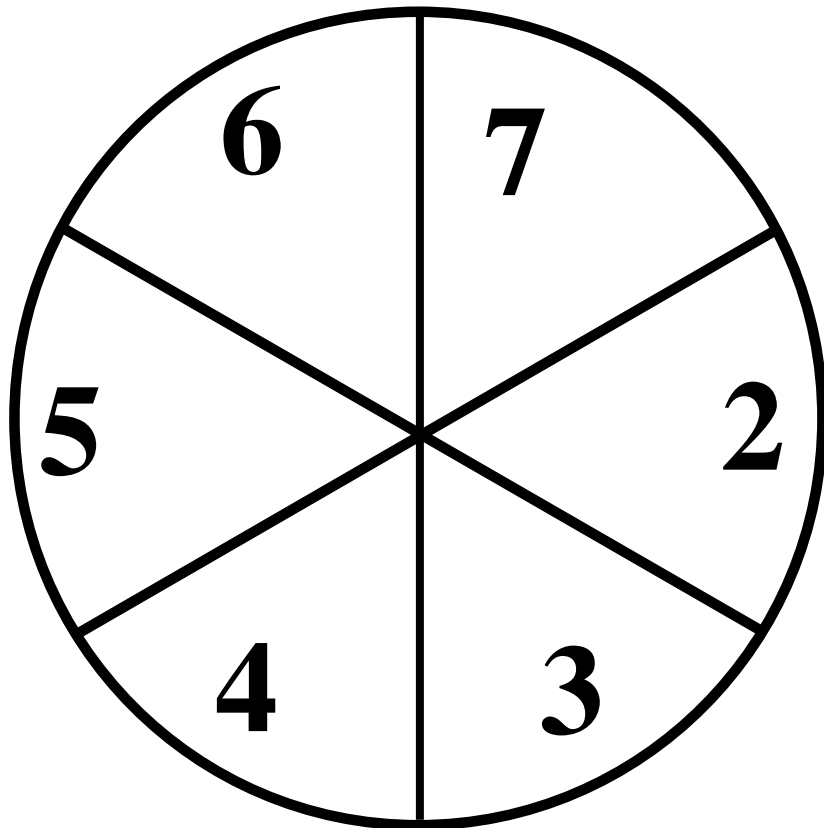
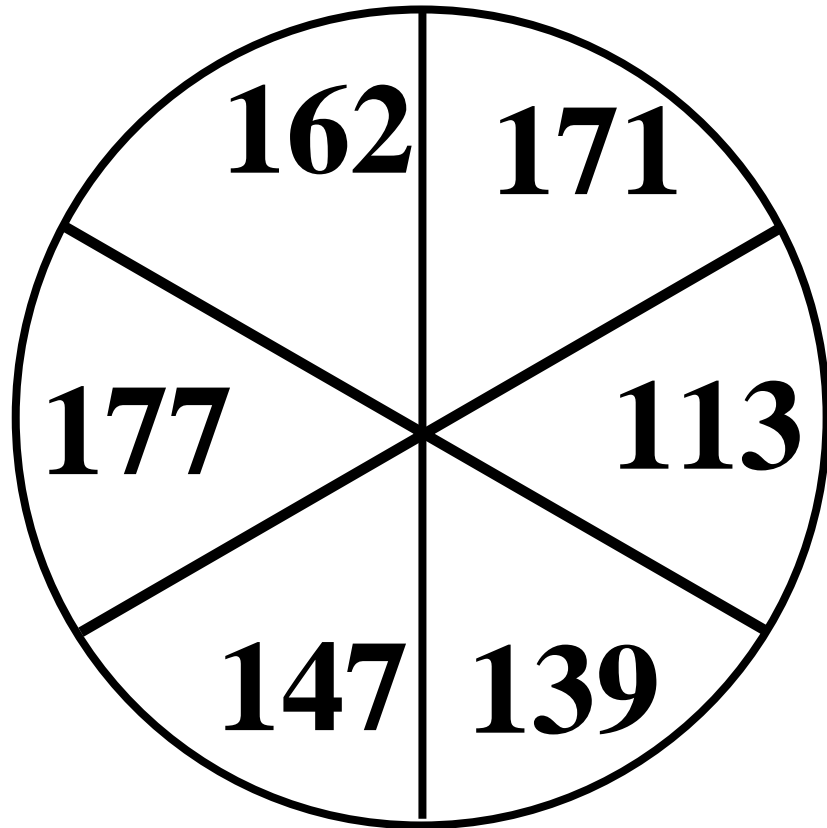
Spinners



Dividend



Divisor



Remainder Sheet

Materials:

9 Cups

Resource sheet 12b

Counters or any other manipulative

1-9 spinner



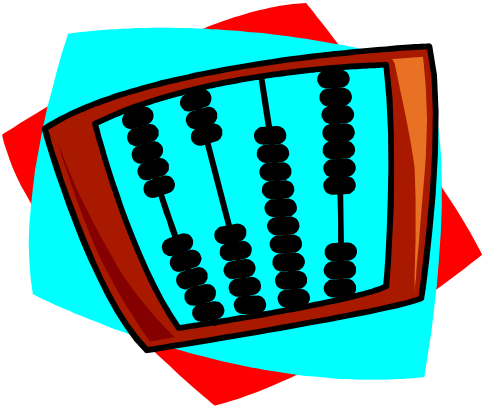
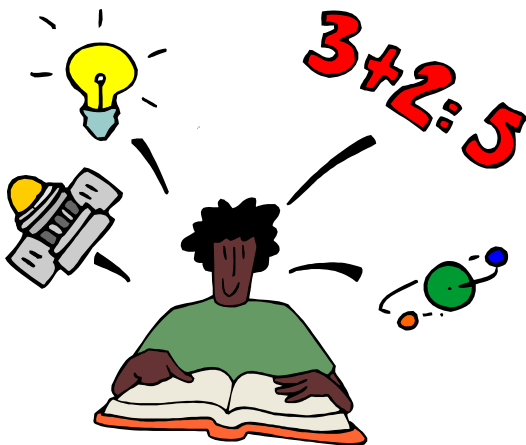
Directions:

- Work in a group to share the manipulatives.
- Have one person take a handful of manipulatives.
- Count all of the manipulatives and record in the total column on Resource Sheet 12b.
- Spin the spinner to find out how many cups your group will need. Then record the number spun in the Number of Groups Column on Resource Sheet 12b.
- Then find the compatible number and record the compatible number in the compatible number column on resource Sheet 12b.
- Then find the estimate and record on Resource Sheet 12b.
- Then distribute the manipulatives into each cup and record the amount in one cup in the Number In each Cup section on Resource Sheet 12b.
- Count the remaining left over manipulatives and record in the “Left Over” column on Resource Sheet 12b.
- Continue for 5 more times.



Remainder Sheet

Total	Number of Groups	Compatible Number	Estimate	Number in Each Cup	Number Left Over



Assessment for Day 3

Directions- Solve each problem.

- A. Dee was putting stickers on her birthday invitations. She had a total of 65 stickers. If she was going to invite 8 friends, how many stickers will be on each invitation?

Total	Number of friends	Compatible Number	Estimate	Amount of Stickers in each invitation	Stickers Left over

Dee would put _____ stickers in each invitation.

- B. Ryan had 14 lollipops and he wanted to give each of his 3 friends an equal amount. Look at his work and decide if he was correct.



Total	Number of friends	Compatible Number	Estimate	Amount of lollipops for each friend	Lollipops left over
13	3	9	3	3	4

Summative Assessment

Directions: Solve.

1. David had 20 sticks of gum. He gave 5 people an equal amount of sticks. How many sticks did each person get?

Ⓐ 5
Ⓑ 4
Ⓒ 2
Ⓓ 6

2. Darnell drew 28 pictures for his 4 grandparents. If he gave an equal amount of pictures to them, how many would each of them receive?

Ⓐ 5
Ⓑ 4
Ⓒ 8
Ⓓ 7

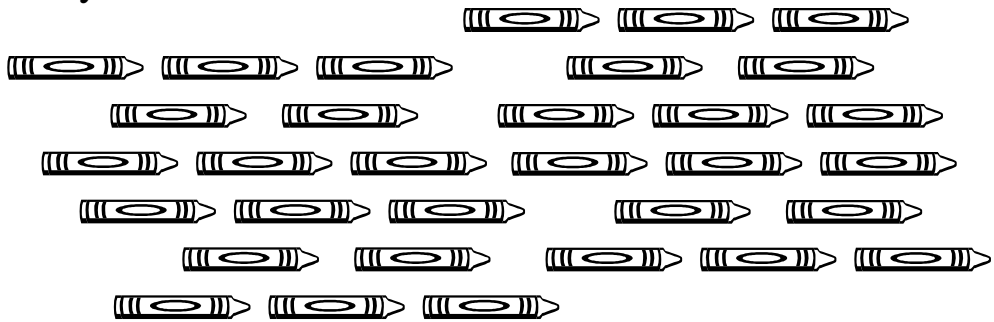
3. Pia baby-sat for her cousins. She watched them for 24 hours over 6 days. She watched them an equal amount of time each day. How many hours did she watch them a day?

Ⓐ 3
Ⓑ 4
Ⓒ 12
Ⓓ 6

Summative Assessment

4. Use the grid below to solve the number sentence
 $18 \div 6 = \underline{\hspace{1cm}}?$

5. Use the pictures below to solve. Amber has to put all the crayons into boxes. Each box only holds 6 crayons. How many boxes will she need?

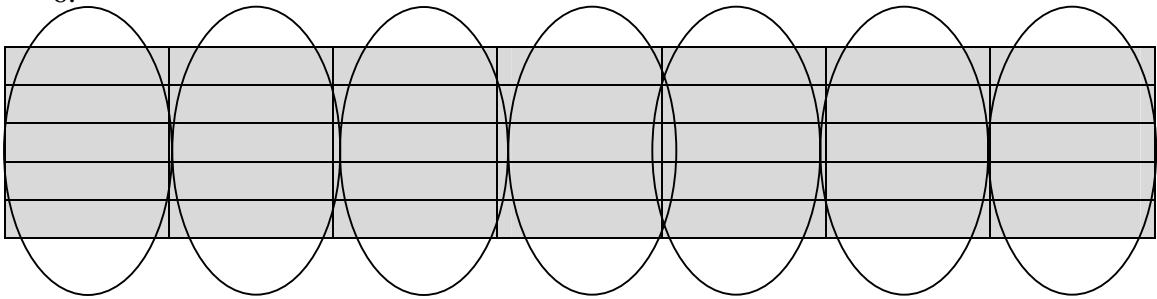


Total Number of Crayons	Number in Each Box	Compatible Number	Estimate	Number of Boxes	Number Left over

Amber will need _____ boxes because _____

Summative Assessment

6.



Part A- Write a division sentence to represent the picture above.

	÷		=	
--	---	--	---	--

Part B- Use what you know about division to explain why you know your answer is correct. Use number words and/or symbols in your explanation.

7. Write as many different division number sentences can you get from the dividend 24?

Use grid paper to help you.

Summative Assessment- Answer Sheet

Directions: Solve.

8. David had 20 sticks of gum. He gave 5 people an equal amount of sticks. How many sticks did each person get?

Ⓐ 5

Ⓑ 4

Ⓒ 2

Ⓓ 6

9. Darnell drew 28 pictures for his 4 grandparents. If he gave an equal amount of pictures to them, how many would each of them receive?

Ⓐ 5

Ⓑ 4

Ⓒ 8

Ⓓ 7

10. Pia baby-sat for her cousins. She watched them for 24 hours over 6 days. She watched them an equal amount of time each day. How many hours did she watch them a day?

Ⓐ 3

Ⓑ 4

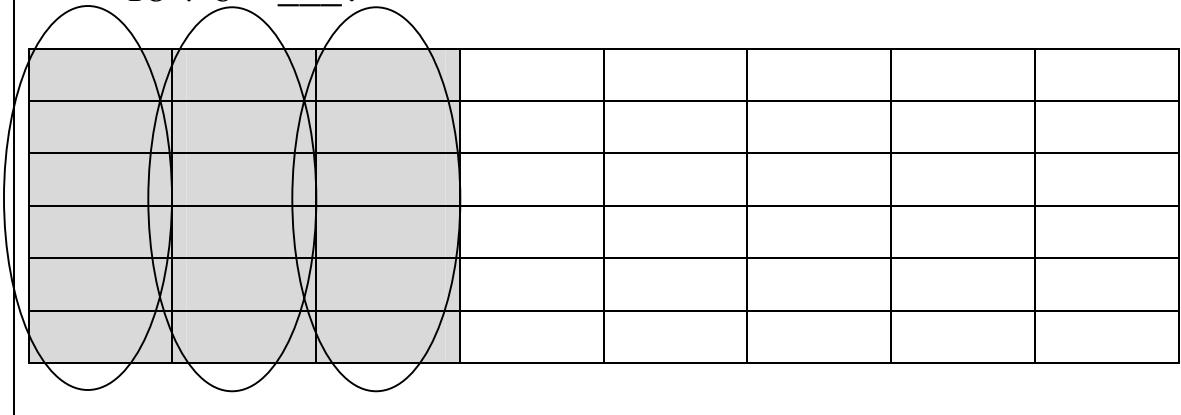
Ⓒ 12

Ⓓ 6

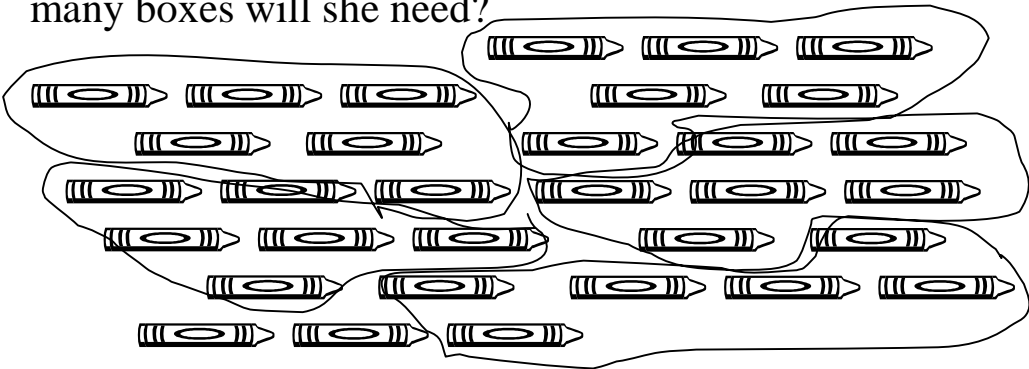
Summative Assessment- Answer Sheet

11. Use the grid below to solve the number sentence

$18 \div 6 = \underline{\hspace{1cm}}?$



12. Use the pictures below to solve. Amber has to put all the crayons into boxes. Each box only holds 6 crayons. How many boxes will she need?

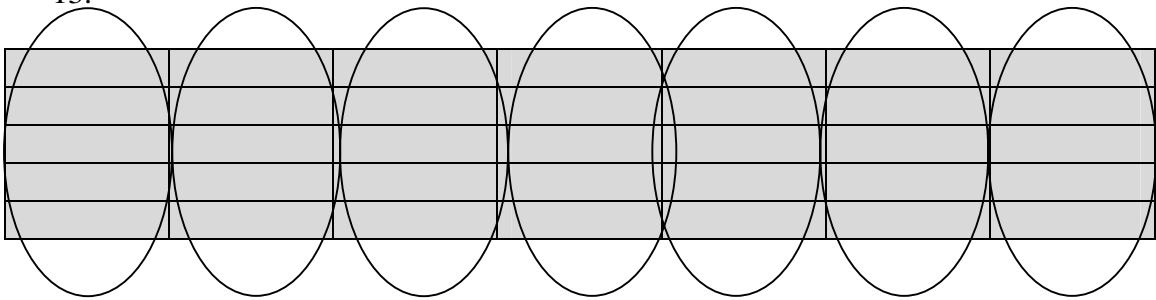


Total Number of Crayons	Number in Each Box	Compatible Number	Estimate	Number of Boxes	Number Left over
<div>32</div>	<div>6</div>	<div>30</div>	<div>5</div>	<div>5</div>	<div>2</div>

Amber will need 6 boxes because there were two crayons left over.

Summative Assessment- Answer Sheet

13.



Part A- Write a division sentence to represent the picture above.

35	\div	7	$=$	5
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Part B- Use what you know about division to explain why you know your answer is correct. Use number words and/or symbols in your explanation.

I know my answer is correct because there were 35 total boxes. I then made groups of 7 and counted how many that were in each group to get 5.

14. Write as many different division number sentences can you get from the dividend 24?

Use grid paper to help you.

$24 \div 1 = 24$	$24 \div 2 = 12$	$24 \div 3 = 8$	$24 \div 4 = 6$
$24 \div 6 = 4$	$24 \div 8 = 3$	$24 \div 12 = 2$	$24 \div 24 = 1$

